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(54) **SHOULDER PROSTHESIS CUP INCLUDING SECURING RIBS**

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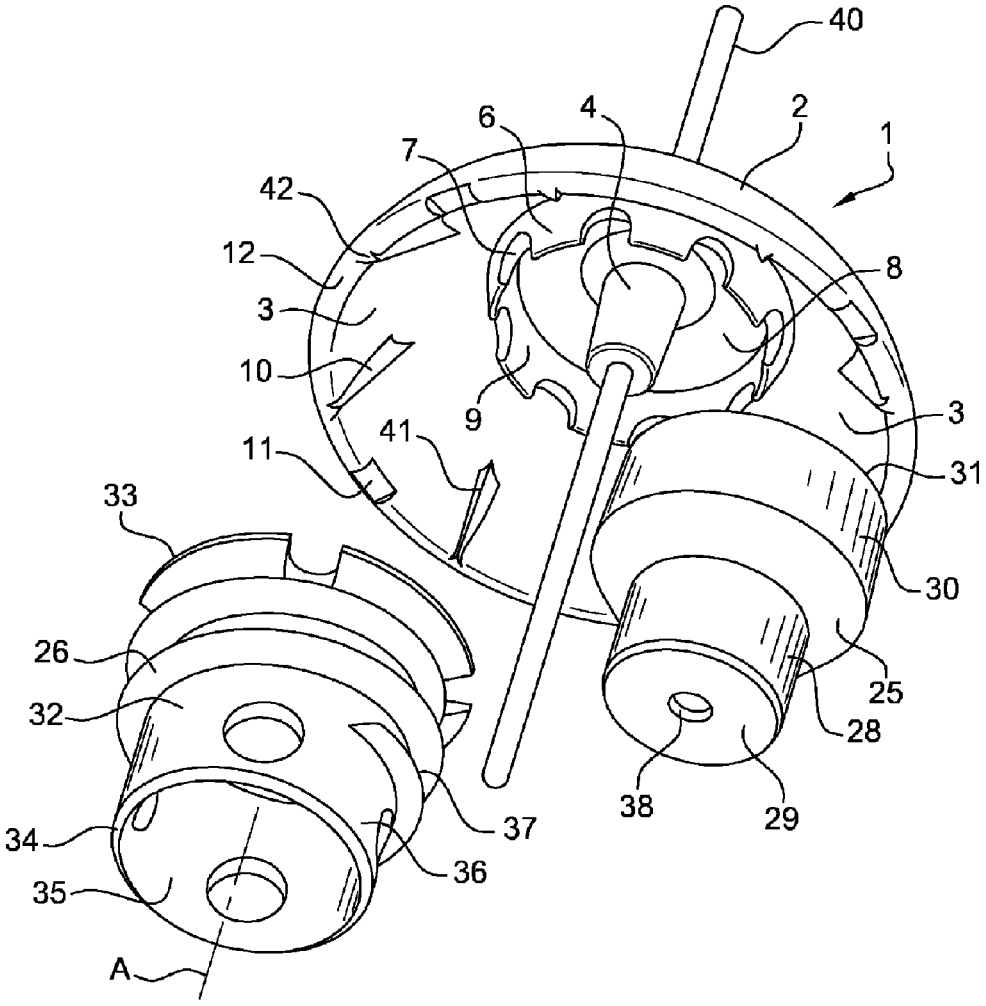
(57) **ABSTRACT**

The invention relates to a prosthesis cup (**1**), in particular for a shoulder prosthesis, comprising a shell (**2**) substantially in the shape of a hollow spherical cap defining a concave inner surface (**3**). The shell (**2**) includes anchoring means which project from the inner surface (**3**) and are shaped to penetrate a bone and anchor the cup (**1**) therein. The invention is characterised in that the anchoring means are shaped to trigger the rotation of the cup (**1**) as they penetrate the bone.



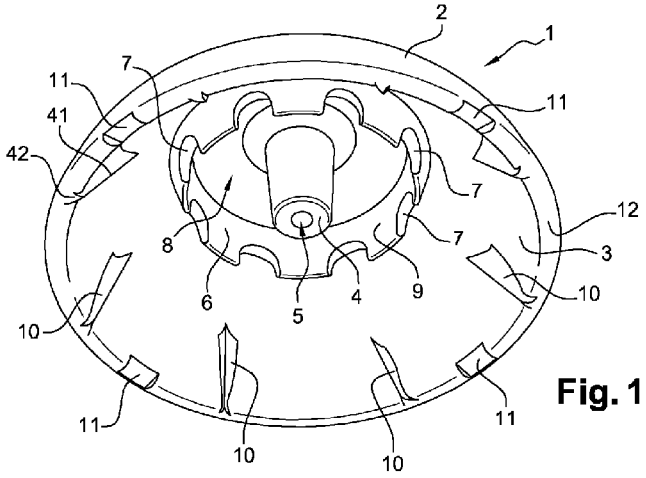

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Fig. 1

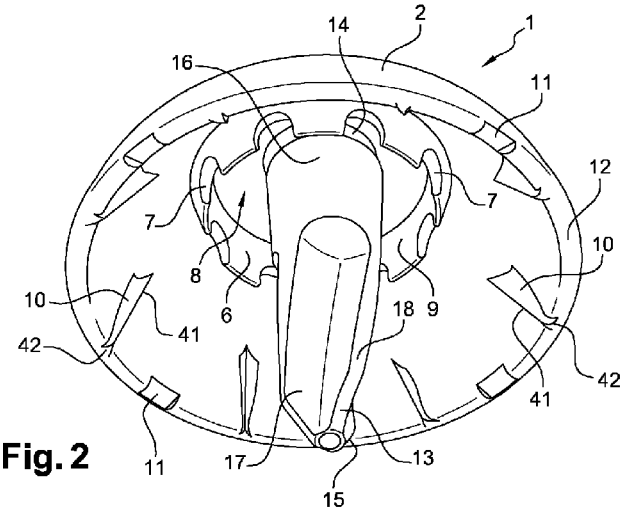
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Fig. 2

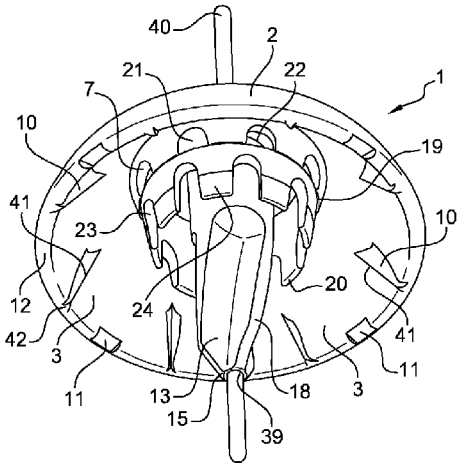
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Fig. 3

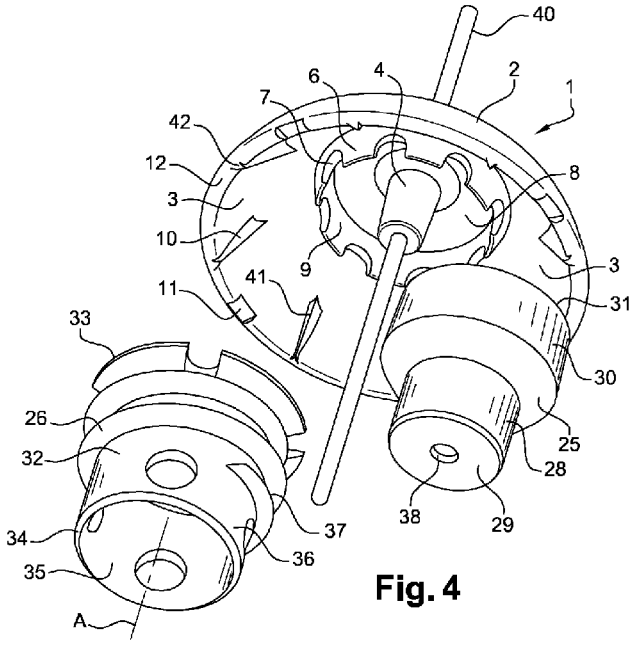
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Fig. 4

SHOULDER PROSTHESIS CUP INCLUDING SECURING RIBS

TECHNICAL FIELD

[0001] The present invention relates to a prosthesis cup, in particular a shoulder prosthesis cup.

RELATED ART

[0002] In France, approximately 15,000 shoulder prostheses are placed each year, including total shoulder prostheses, called standard prostheses, reverse prostheses, and more recently resurfacing prostheses.

[0003] This figure, which shows a clear increase in recent years, is in particular due to the increase in the number of pathologies for which the placement of a shoulder prosthesis is now indicated.

[0004] In this context, prosthetic shoulder surgery remains a very specialized, highly technical surgery, requiring a long learning period and the use of ancillaries that are often complex. It is therefore desirable to simplify the prostheses and ancillaries so as to facilitate the procedure, make it more reproducible, and therefore decrease postoperative complications. Such a simplification of the ancillary and the procedure may also have the advantage of decreasing the costs of those operations to place shoulder prostheses.

[0005] Several types of shoulder prosthesis exist. Certain traditional prostheses, like that described in US 2004/153161, are fixed on the humerus, using a humeral rod, after a resulting resection of the bone. The installation of a humeral rod requires a significant recess in the bone to receive it, thereby decreasing the bone capital and making the bone more fragile. The placement of such a prosthesis is long and complex. After the rod is installed in the recess, the space between the bone and the humeral rod is generally filled with cement. With time, the cement may become dislocated and no longer ensure correct fixing of the rod.

[0006] Resurfacing prostheses also exist, like that described in FR 2,928,827, which are placed by epiphysis of the humerus after potential light planing of the surface of the epiphysis. Such prostheses are not necessarily anchored in the bone as previously described.

[0007] When a simple resurfacing of the epiphysis is not indicated, for example if the bone is too fragile, the surgeon may choose to use an intermediate so-called "half-resurfacing" technique where part of the epiphysis is resected. The surgeon is then called upon to use a prosthesis like that described in document EP 0,538,895, including a cup designed to replace the part of the epiphysis that is resected and an anchoring screw ensuring fastening of the cup on the bone.

[0008] It is also known from document WO 2008/146124 to replace the anchoring screw previously described with a substantially cylindrical anchoring pin. The cup is then provided with a coupling stem cooperating by interlocking with the cavity, with a complementary cylindrical shape, formed to that end in the anchoring pin. Such a cup is then kept in place owing to the pressure exerted by the glenoid. However, the nature of the coupling of the cup and the anchoring pin does not make it possible to avoid rotation of the cup after it is implanted, which can cause problems. Furthermore, the cup simply being interlocked in the cavity of the anchoring pin, the anchoring of the cup on the humeral head may prove insufficient, and thereby cause pain or discomfort for the patient.

[0009] All of the known cups are specifically suitable for a specific surgical technique. The surgeon must therefore learn the different techniques and must have several ancillaries adapted to each technique. Furthermore, if the surgeon encounters difficulties during an operation, it is not possible for him to adapt the prosthesis, for example by changing the implantation method of the cup.

BRIEF SUMMARY

[0010] The present invention aims to resolve all or some of the various aforementioned drawbacks.

[0011] In this context, the present invention aims to propose an adaptable cup making it possible to use different techniques (traditional, resurfacing, and semi-resurfacing), which preserves the bone capital of the patient and guarantees correct anchoring of the cup, while preventing rotation thereof after the operation.

[0012] To that end, the invention relates to a prosthesis cup, in particular for a shoulder prosthesis, comprising a shell substantially in the shape of a hollow spherical cap defining a concave inner surface, the shell including anchoring means that project from the inner surface and are shaped to penetrate a bone and anchor the cup therein, characterized in that the anchoring means are shaped to trigger the rotation of the cup as they penetrate the bone.

[0013] Thus, a cup according to the invention makes it possible to guarantee simple and quick anchoring when the resurfacing or half-resurfacing technique is used. The anchoring means, by penetrating the bone, are shaped to impart a rotation to the cup: this rotation results in guaranteeing uniform anchoring of the cup, guaranteeing better resistance to pulling out of the cup, and preventing the cup from rotating once it is implanted. The anchoring means provide better resistance to pulling out of the cup according to the invention.

[0014] According to one embodiment, the anchoring means include at least one rib. Each rib increases the anchoring of the cup in the bone and/or improves the resistance to pulling out of the cup. Each rib also makes it possible to prevent the cup from rotating once it is placed on the patient. Advantageously, each rib is integral with the shell and is therefore easy to make.

[0015] According to one possibility, each rib has at least one sharp edge with a substantially helical portion. Such a substantially helical portion is easy to produce and may behave like a threading in the bone.

[0016] According to one feature, the anchoring means are shaped to cause the cup to rotate by approximately 10° upon impaction.

[0017] According to one possibility, each rib has one end situated near the edge of the shell.

[0018] According to one embodiment, the cup also includes a coupling stem extending from the inner surface, designed to allow coupling of the cup with a fastening element, in particular an anchoring screw or an anchoring pin.

[0019] According to one possibility, the cup also includes a wall, extending from the inner surface and substantially in the shape of a ring arranged concentrically around the coupling stem. Thus, a cup according to the invention is adaptable: The coupling stem makes it possible, depending on the surgeon's needs, to couple the cup to a fastening element. The wall makes it possible on the one hand to anchor the cup directly in

the bone to improve the fastening thereof, and on the other hand, depending on the needs, to couple the cup with an intermediate member having a ring portion shape and suitable for being received in the recess delimited between said wall and the coupling stem. Such an intermediate member may, for example, be a coupling member for coupling the cup with an anchoring screw or with an intermediate band making it possible to space the cup away from the bone for better adaptation of the prosthesis on the patient. The wall therefore allows the surgeon to choose the technique he will use to fasten the cup on the patient and possibly to change techniques during the operation. Given the possible compatibility between the anchoring pin and the intermediate member, the surgeon also has the possibility of using both at the same time.

[0020] According to one feature of the invention, the wall is crenulated. A crenulated wall makes it possible to improve the anchoring of the cup in the bone. The crenulation also makes it possible to prevent the cup from rotating after it is inserted in the bone. Lastly, the crenulated wall prevents any intermediate member that may have been used from rotating.

[0021] According to one embodiment, the wall has a thickness that decreases as it moves away from the inner surface. The decrease in the thickness of the wall moving away from the inner surface gives the wall an improved capacity to penetrate the bone.

[0022] According to one embodiment, the wall delimits, with the coupling stem, a recess configured to receive an intermediate member having a substantially tapered outer surface.

[0023] According to one possibility, the shell also has at least one notch arranged on the edge of the shell. Such a notch is useful for fastening a tool designed to keep the cup in position and to cause a 10° rotation upon impaction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The invention will be well understood using the following detailed description thereof provided in light of the appended drawing, showing, as one non-limiting example, one embodiment of a cup, in which:

[0025] FIG. **1** is a diagrammatic perspective view of a cup;

[0026] FIG. **2** is a diagrammatic perspective view of the cup of FIG. **1** coupled with an anchoring pin;

[0027] FIG. **3** is a diagrammatic perspective view of the cup of FIG. **1** coupled with an intermediate band and an anchoring pin;

[0028] FIG. **4** is a diagrammatic perspective view of the cup of FIG. **1**, a coupling member and an anchoring screw for fastening the prosthesis.

DETAILED DESCRIPTION

[0029] A prosthesis cup **1**, illustrated in FIG. **1**, includes a shell **2** substantially in the shape of a hollow spherical cap. The shell **2** delimits a concave inner surface **3** and has a coupling stem **4** that extends from that inner surface **3** at the pole of the shell **2**. The coupling stem **4** is, for example, provided with a through orifice **5** extending along the axis of the spherical cap. The cup **1** also includes a wall **6** that extends from the inner surface **3** and has a substantially tubular shape. This wall **6** includes eight gaps **7** formed at the free end thereof. The number of gaps **7** may of course be adapted as needed or depending on the size of the cup **1**. Likewise, the shape of each gap **7** is adaptable and can, for example, be rounded, as illustrated in FIG. **1**, or rectangular. Of course, the depth of each gap **7** may vary until it is substantially equal to the height of the wall **6**. The thickness of the wall **6** decreases as it moves away from the inner surface **3**. The wall **6** is arranged concentrically with the coupling stem **4**, such that they delimit a recess **8** substantially in the shape of a ring. The face **9** of the wall **6** arranged across from the coupling stem **4** has a female tapered shape.

[0030] The cup **1** illustrated in FIG. **1** also has anchoring means protruding from the inner surface **3** configured to penetrate the bone while causing the cup **1** to rotate upon the penetration of said anchoring means. Such anchoring means for example include eight ribs **10** formed on the inner surface **3** and integral with the cup **1**. The number of ribs **10** can of course be adapted depending on the needs or depending on the size of the cup **1**. Each rib **10** extends along a unique longitudinal axis, off-centered relative to the axis of the spherical cap. Each rib **10** has a sharp edge **41**, arranged at the free end of the rib **10**, having a substantially helical portion **42**. The substantially helical portion **42** of the sharp edge **41** is chosen so that the penetration thereof in the bone, during anchoring of the cup **1**, facilitates a 10° rotation of the cup **1** during impaction. Lastly, each rib **10** is arranged so as to have one end situated near the edge **12** of the shell **2**. Advantageously, each of the ends situated near the edge **12** of the cup **1** is tapered so as to form a harpoon in order to increase the resistance to pulling out of the cup **1**.

[0031] Lastly, the cup **1**, illustrated in FIG. **1**, for example includes four notches **11** arranged on the edge **12** of the shell **2**.

[0032] A surgeon can implant the cup **1** in several ways outlined below, depending on his needs.

[0033] The surgeon first has the option of using an anchoring pin **13**, illustrated in FIG. **2**, to implant the cup **1**, for example in the context of resurfacing of the epiphysis of the bone.

[0034] The anchoring pin **13** extends along a longitudinal axis between a first end **14**, designed to cooperate with the cup **1**, and a second end **15**, designed to cooperate with the bone. It has a generally tapered shape. The anchoring pin **13** includes a first portion **16** designed to allow coupling of the cup **1**. This first portion **16** has a coupling orifice, not shown, extending along the longitudinal axis of the pin **13** and emerging on the first end **14**. The shape of this coupling orifice complements the shape of the coupling stem **4** of the cup **1**, so as to allow interlocking thereof in the coupling orifice of the pin **13**, to couple the cup **1** and the pin **13**. Advantageously, the coupling stem **4** and the coupling orifice are tapered. For example, the coupling stem **4** forms a male Morse cone, and the coupling orifice of the pin **13** is a complementary female Morse cone.

[0035] The pin **13** also includes a second portion **17** designed to anchor the pin in a bone. To that end, this second portion **17** includes three helical sharp edges **18** allowing the pin **13** to penetrate the bone like a drill while causing the pin **13** to rotate. This rotation of the pin **13** favors its anchoring and increases the resistance of said pin **13** to pulling out. Advantageously, the pin **13** is shaped to cause the cup **1** to rotate in the same direction of rotation as each rib **10**.

[0036] When the anchoring pin **13** is used to fix the cup **1**, the surgeon first fixes the pin **13** in the epiphysis of the bone, then couples the cup **1** thereon by inserting the coupling stem **4** into the coupling orifice of the pin **13**. The wall **6** and the ribs **10** are then pushed into the epiphysis of the bone to ensure additional anchoring of the cup **1**.

[0037] The wall **6** has a height not exceeding 10% of the radius of the spherical cap. For example, the height of the wall **6** is smaller than 7 mm for a radius of the spherical cap of approximately 100 mm. When the epiphysis of the bone has been partially or completely resected, the height of the wall **6** may prove insufficient to be anchored in the bone. The surgeon then has the option of using an intermediate band **19** illustrated in FIG. **3**. Such an intermediate band **19** has a tubular body **20** extending along a longitudinal axis between two opposite ends. The tubular body **20** comprises a coupling portion **21** having a shape suitable for being inserted into the recess **8** of the cup **1**, such that the outer surface **22** of that coupling portion **21** is in contact with the face **9** of the wall **6** arranged across from the coupling stem **4**, to ensure coupling without play of the cup **1** and the intermediate ring **19**. The coupling portion **21** may optionally include a stop, not shown, protruding from the outer surface **22**, said stop being designed to cooperate with one of the gaps **7** of the cup **1** to lock the rotation of the intermediate band **19** in the recess **8**.

[0038] The intermediate band **19** also has an anchoring portion **23** including an extension wall **24** having a shape similar to the wall **6**. Thus, the extension wall **24** constitutes an extension of the wall **6** and is designed to be anchored in the bone in the same way as the wall **6**. Thus, the intermediate band **19** can be anchored in the bone, the cup **1** being coupled thereon. When the intermediate band **19** is coupled with the cup **1**, the free end of the intermediate band **19** is situated at a distance from the pole of the spherical cap of approximately 100% of the radius thereof. Thus, the free end of the intermediate band **19** is flush with the edge **12** of the shell **2**, such that the intermediate band **19** has a maximum height to favor anchoring of the cup **11** making it possible to completely remove the cup **1** by sawing the bone using a saw guided by the edge **12** of the shell **2**.

[0039] The surgeon can also use a coupling member **25** and an anchoring screw **26** to fix the cup, illustrated in FIG. **4**.

[0040] The coupling member **25** includes a first portion **27** with a substantially tapered shape having a male intermediate mounting portion **28** forming a male Morse cone **29**. The coupling member **25** also has a second tubular portion **30** provided with a cavity, not shown, that is substantially tapered and delimits a female intermediate mounting portion. The female intermediate mounting portion forms a female Morse cone, not shown, sized to cooperate by shape matching with the coupling stem **4** of the cup **1**. According to the embodiment shown in figures, the coupling member **25** has a male Morse cone **29** and a female Morse cone whereof the respective axes of symmetry are combined. Alternatively and not shown, the male Morse cone **29** and the female Morse cone can have distinct respective axes of symmetry that are offset and/or not parallel. The outer surface **31** of the second tubular portion **30** has a shape suitable for being inserted into the recess **8** of the cup **1**, such that the outer surface **31** of that second tubular portion **30** is in contact with the face **9** of the wall **6** arranged across from the coupling stem **4**, to ensure coupling without play of the cup **1** and the coupling member **25**.

[0041] The anchoring screw **26**, illustrated in FIG. **4**, includes a tubular body **32** extending along a longitudinal axis A between a proximal end **33**, designed to cooperate directly or indirectly with the cup **1** or the coupling member **25**, and an opposite distal end **34** designed to be fixed in the epiphysis of the bone. The tubular body **32** delimits an inner peripheral surface **35**, illustrated in FIG. **4**, and an outer peripheral surface **36** provided with screwing means, made in the form of a threading **37**, to allow the screw **26** to be screwed into the bone.

[0042] The inner peripheral surface **35** delimits a female mounting portion, not shown, that extends substantially from the proximal end **33** and that is sized to cooperate by shape matching with the male Morse cone **29** of the coupling member **25**. In one embodiment not shown in the figures, the female mounting portion is sized to cooperate by shape matching with the coupling stem **4** of the cup **1** and to be inserted directly into the recess **8**.

[0043] Thus, the anchoring screw **26** described above makes it possible to fix the cup **1**. When the tubular body **32** of the screw **26** is fixed in the bone, the correct anchoring of the screw **26** is ensured using the threading **37** and the placement procedure is simplified, since the coupling of the cup **1** on the screw **26** directly or indirectly with the coupling member **25** is done by simple interlocking.

[0044] In order to facilitate the positioning of the cup **1** and the anchoring pin **13** or the coupling member **25**, the latter each include a through orifice **38**, **39** extending along the longitudinal axis of the coupling member **25** or the anchoring end **13**, respectively. Thus, irrespective of the method used to implant the cup **1**, the surgeon has the option of using a rod **40**, illustrated in FIGS. **3** and **4**, to align the cup **1** and the anchoring pin **13** or the coupling member **25**. The rod **40** is simply inserted into the through orifice **5** of the cup **1** and into the through orifice **39** of the anchoring pin **13** or into the through orifice **38** of the coupling member **25**. The rod **40** may then be inserted into an orifice formed to that end in the bone to guarantee correct orientation of the cup **1**.

[0045] Thus, the cup **1** according to the invention described above is extremely adaptable to the various surgical techniques commonly used to place a shoulder prosthesis. The wall **6** and the ribs **10** make it possible to anchor the cup **1** directly in the bone. The wall **6** also makes it possible, depending on the surgeon's needs, to couple the cup **1** to a coupling member **25** or an anchoring screw **26** assuming the shape of a ring portion adapted to be received in the recess **8** delimited between the wall **6** and the coupling stem **4**. The ribs **10**, by penetrating the bone, are shaped to impart a rotation of the cup **1**: this rotation results in guaranteeing uniform anchoring of the cup **1**, ensuring better resistance of the cup **1** to pulling out, and preventing the cup **1** from rotating once it is implanted.

[0046] Of course, the example embodiment described above is in no way limiting, and other details and improvements may be made to the cup **1** according to the invention, without going beyond the scope of the invention, where other forms of cup may be considered.

1. A prosthesis cup, in particular for a shoulder prosthesis, comprising a shell substantially in the shape of a hollow spherical cap defining a concave inner surface, the shell including anchoring means that project from the inner surface and are shaped to penetrate a bone and anchor the cup therein, wherein the anchoring means are shaped to trigger the rotation of the cup as they penetrate the bone.

2. The cup according to claim **1**, wherein the anchoring means include at least one rib.

3. The cup according to claim **2**, wherein each rib has at least one sharp edge with a substantially helical portion.

4. The cup according to claim **1**, wherein the anchoring means are shaped to cause the cup to rotate by approximately 10° upon impaction.

5. The cup according to claim **2**, wherein each rib has one end situated near the edge of the shell.

6. The cup according to claim **1**, wherein the cup also includes a coupling stem extending from the inner surface, designed to allow coupling of the cup with a fastening element, in particular an anchoring screw or an anchoring pin.

7. The cup according to claim **6**, wherein the cup also includes a wall, extending from the inner surface and substantially in the shape of a ring arranged concentrically around the coupling stem.

8. The cup according to claim **7**, wherein the wall is crenulated.

* * * * *